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PATENT SPECIFICATION

NO DRAWINGS

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COMPLETE SPECIFICATION

Combustion Mixtures

We, D. SEBEL & COMPANY LIMITED of 177 West Street, Erith, Kent, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to compositions for generating gas for the purpose, *inter alia*, of actuating gas pressure operated devices such for instance as the propulsion of rockets and as the gas generative source for reaction motors.

Generating charges are already known which on local heating are capable of maintaining non detonating decomposition. These charges comprise mixtures in compacted form containing guanidine nitrate and a poly-nitro- or poly-nitroso-derivative of phenol or of hydroxy-nitro, carboxy- or methyl substitution derivatives of phenol in which the guanidine nitrate is present in proportions predominating over the total proportions of the other constituents and the phenol derivative is present in sufficient proportion to render the compact mixture capable of sustaining its own non-detonating decomposition once initiated.

Whilst such gas generating charges may be suitable for rocket propulsion and purposes such as blasting operations and dispersion of volatilisable materials or the like they are not wholly satisfactory for purposes where it is highly desirable that the decomposition is uniform throughout the decomposition period with no excessive local overheating within the charge.

An object of the present invention is to provide a gas generating charge preferably in compacted form which burns regularly to produce throughout its burning life a substantially even gas generation and homogeneous decomposition at a substantially steady temperature.

Broadly the invention comprises a gas generating charge comprising mixtures preferably in granular or compacted form which include guanidine nitrate or similar amidic derivatives of carbonic acid, at least one oxidising salt, and a catalyst which serves to control and to modulate the burning, the oxidising salt and the catalyst being present in a particle size smaller than that of the amidic derivative.

Conveniently fillers and/or bonding agents may be incorporated, for example kaolin or china clay or wood flour.

The invention has particular application for use as the fuel in reaction motors, particularly small reaction motors of the type used in toy or scale aircraft or other vehicles, where it is desired to have an even thrust throughout the length of burning without any excessive local overheating which would damage the relalatively light gauge casing of the motor.

As an example of a suitable mix for this purpose the following is given:—

80 to 90 parts guanidine nitrate
35 to 50 parts potassium dichromate
.5 to 2 parts of sesquioxide of iron
1 to 3 parts kaolin or china clay

All parts being by weight.

The china clay or kaolin serves not only as a filler but also as a bonding agent enabling the mixture to be compacted by pressure without the inclusion of any separate bonding agent. In addition to bonding agents binding agents may also be employed to give adhesion between the particles in the pellet or charge. By varying the amount of filler the duration of burning can be controlled within certain limits.

Whilst it has been found that for the purpose stated sesquioxide of iron is at this date a preferred catalyst which ensures substantial completion of the decomposition of the guanidine nitrate other materials may also be used for example vanadium pentoxide or other vanadate or certain compounds of molybdenum.

Furthermore there may be included into the mixtures small amounts of heat resisting materials in addition to clay or kaolin such

for example as asbestos fibre which functions solely as a heat resisting material and not as a bonding agent.

In addition small quantities of a material such as potassium nitrate or potassium permanganate can be introduced up to .5 parts by weight since these compounds serve to produce more complete combustion.

The mixture is ground to a suitably small mesh size. The actual grain size used in the mixture depends upon the purpose for which the gas generating charge is required and the rate of burning and consequent rate of gas production and pressure created, the smaller the grain size the higher the speed of burning. Conveniently the amidic derivative is ground to at least 40 mesh and the oxidising salt and catalyst to at least 100/120 mesh.

With pellets made in accordance with the present invention the burning temperatures can be in the region of 1200 to 1300° C. and the fuel burns satisfactorily i.e. at a steady rate up to pressures of 100 lbs. per square inch.

The mixtures of the present invention can be used more particularly in the compacted form as pellets or blocks in a large variety of sizes and can be stored safely without danger of spontaneous combustion or accidental ignition otherwise than, of course, by a proper ignition temperature. Conveniently the pellets may be coated with a thin film of inflammable lacquer for example nitro cellulose which facilitates their handling without crumbling or fracture and at the same time the film is burnt away when the pellet is fired.

Whilst the invention has particular application for use in miniature gas reaction motors, because the casings of these motors are usually made of aluminium or aluminium alloy in order to save weight and the mixtures of the invention have the advantage that local overheating is avoided, the mixtures may be used for any other purpose where gas production and gas dissemination is required and additional agents may be added to the mixture, for example to increase the burning temperature or to give any other effect required. Thus colouring materials or dyestuffs can be added to the mixture to give off a distinctively coloured combustion gas.

WHAT WE CLAIM IS:—

1. A fuel for generating gas for operating gas pressure operated devices comprising a homogeneous mixture which includes an amidic derivative of carbonic acid, an oxidising salt, and a catalyst for controlling and modulating the burning of the mixture, the oxidising salt and the catalyst being present in a particle size smaller than that of the amidic derivative.

2. A fuel for generating gas for operating gas pressure operated devices as claimed in claim 1 comprising a mixture in compacted form of guanidine nitrate, an oxidising salt, and sesquioxide of iron.

3. A fuel for generating gas for operating gas pressure operated devices as claimed in claim 2 in which the guanidine nitrate is present in 80 to 90 parts by weight, potassium dichromate 35 to 50 parts by weight, and sesquioxide of iron .5 to 2 parts by weight.

4. A fuel for generating gas for operating gas pressure operated devices as claimed in any of the preceding claims in which a bonding agent is also included.

5. A fuel for generating gas for operating gas pressure operated devices as claimed in claim 4 in which the bonding agent is selected from a group comprising kaolin, china clay and wood flour.

6. A fuel for generating gas for operating gas pressure operated devices as claimed in claims 4 or 5 in which the charge is in the form of a compacted pellet.

7. A fuel for generating gas for operating gas pressure operated devices as claimed in claim 6 in which the charge is in the form of a compacted pellet having a coating of a combustible lacquer.

8. A fuel for generating gas for operating gas pressure operated devices as claimed in claim 7 in which the charge is in the form of a compacted pellet having a coating of a combustible lacquer in the form of a film of nitro-cellulose lacquer.

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